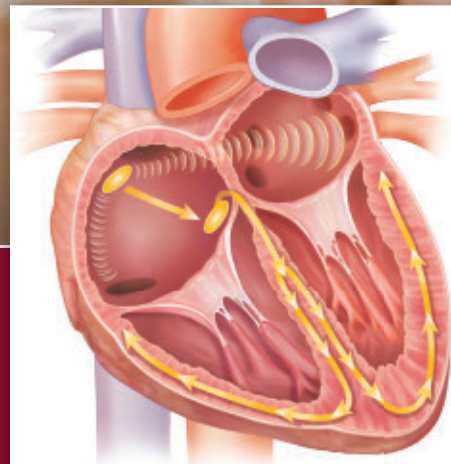


UNDERSTANDING ELECTROPHYSIOLOGY STUDIES



Testing and Treating Your
Heart's Electrical System



A Problem with Your Heart Rhythm

The speed and pattern of a heartbeat is called the **heart rhythm**. The rhythm is controlled by the heart's electrical system. Problems with this system can make the heart beat too slowly or too quickly. Symptoms such as dizziness and shortness of breath can result. If your doctor suspects a heart rhythm problem, he or she may order an **electrophysiology (EP) study**. This test gathers information about the electrical system in the heart. Read on to learn more.

An Electrophysiology Study Can Help

During an EP study, special wires are put into a blood vessel. They are carefully guided into the heart, where they record electrical activity. The heart's electrical pathways can then be mapped out. Information collected during the study helps determine the cause of a heart rhythm problem and what can be done to control it. A type of cardiologist (heart doctor) called an **electrophysiologist** performs the EP study.



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Working with Your Doctor

An EP study can give your doctor information about your heart's electrical system. You and your doctor can discuss why an EP study is recommended and weigh its benefits and risks. The doctor can also discuss other possible options with you. Be sure to get answers to any questions you have.

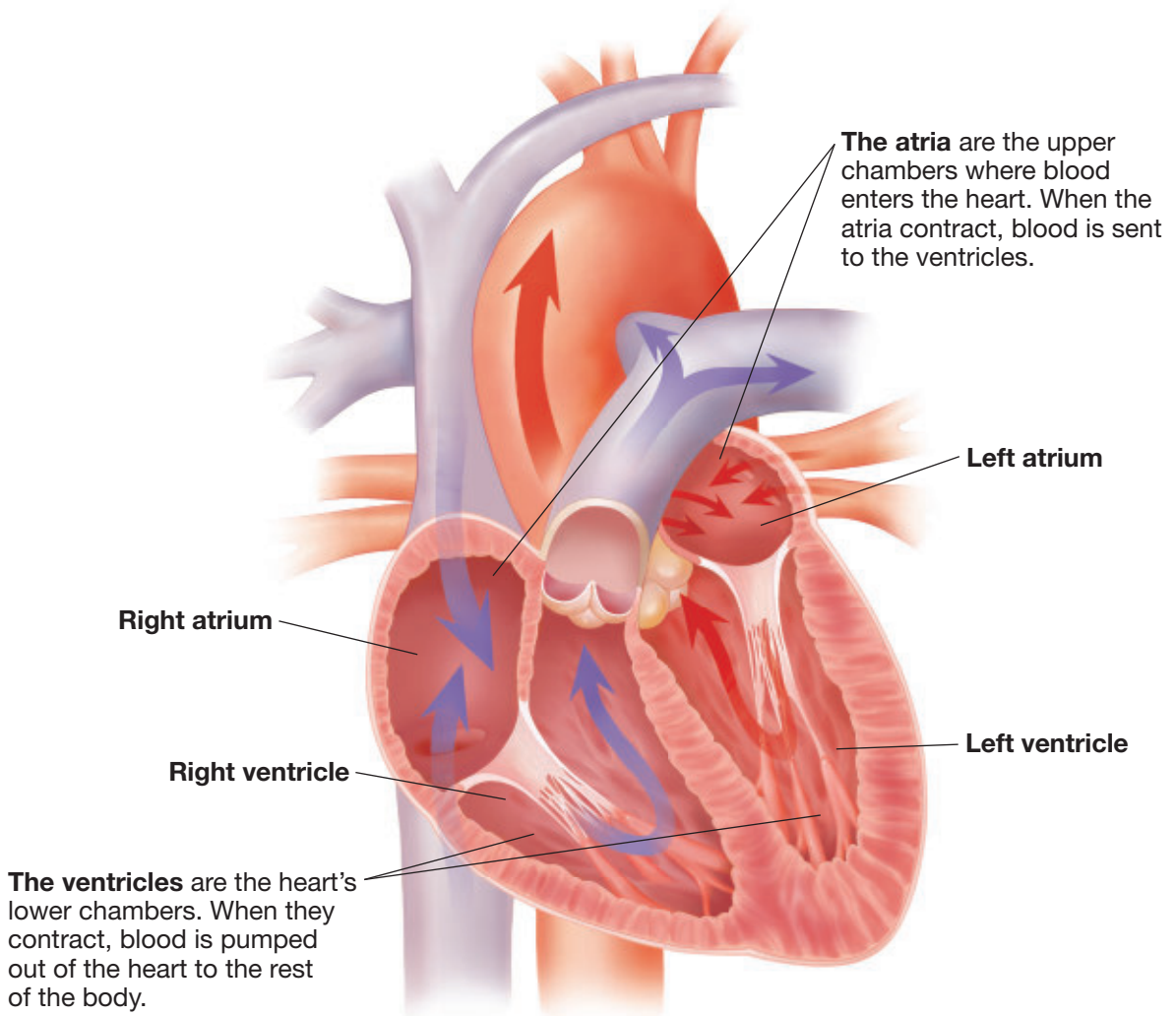


Normal Heart Rhythm

The heart is a muscle that pumps blood throughout the body. The muscle contracts and relaxes (beats) many times a minute. The speed and pattern at which the heart beats is the heart rhythm. Signals from the heart's electrical system control this rhythm.

The Heart Is a Pump

The heart contains four **chambers**. These chambers hold blood as it moves through the heart. The two upper chambers (**atria**) receive blood from the lungs and body. The atria contract to move blood into the two lower chambers (**ventricles**). The ventricles then contract to move blood out to your lungs and body.



The Heart's Electrical System

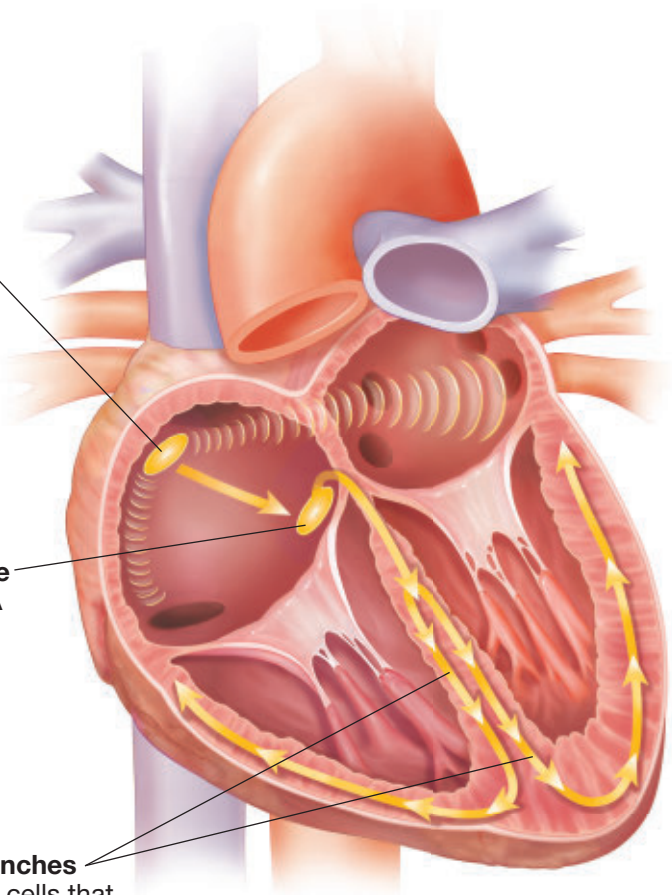
Electrical signals control the heart rhythm. Groups of special cells called **nodes** create or send these signals. As the signals move through the heart, they tell the chambers when to contract and move blood. Signals:

- Start in the right atrium in the **SA node**.
- Travel through the atria to the **AV node**.
- Pass from the AV node to the ventricles along special pathways called **bundle branches**.

The SA (sinoatrial, or sinus) node is the heart's natural pacemaker. It starts each heartbeat by sending an electrical signal that tells the atria to contract.

The AV (atrioventricular) node receives the signal from the SA node after the signal passes through the atria. The AV node then guides the signal to the ventricles.

The bundle branches are pathways of cells that carry the signal through the ventricles. As the signal moves through the ventricles, they contract.



Heart Rhythm Problems

A problem heart rhythm is known as an *arrhythmia*. The heart may beat too slowly or too quickly. This means the heart cannot pump blood properly. As a result, blood doesn't move through the heart and to the body the way it should.

Symptoms of a Heart Rhythm Problem

A problem heart rhythm can cause symptoms ranging from mild to severe. These symptoms can include:

- Palpitations (a fluttering, strong, or fast heartbeat)
- Feeling dizzy or lightheaded
- Fainting or having blackout spells (syncope)
- Being short of breath or having throat tightness
- Feeling weak or tired
- Not being able to perform your usual amount of activity (exercise intolerance)
- Feeling chest pain or discomfort

►► Symptoms of a heart rhythm problem include fatigue, dizziness, and shortness of breath.



Slow Heart Rhythms

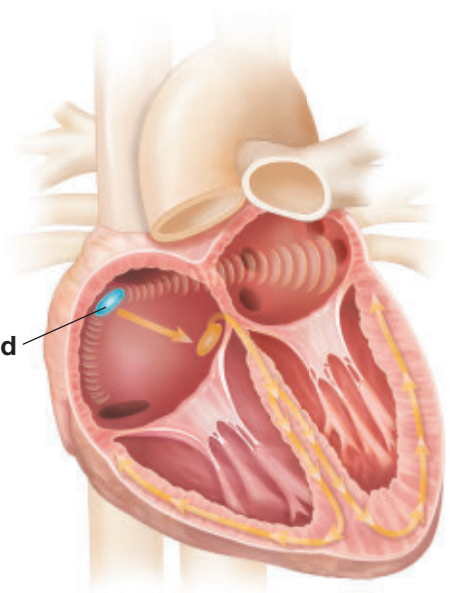
A slow heart rhythm is called **bradycardia**. It can occur when electrical signals are too slow, are not sent, are blocked, or go the wrong way. The heart rhythm may be slow most of the time. Or, it may be slow only from time to time (intermittent).

SA Node Problems

The SA node sets the pace of the heart rhythm. If the SA node sends signals too slowly or skips signals, the heart rhythm will be too slow. There are several types of SA node problems. These include:

- **Sinus bradycardia.** Signals from the SA node are too slow.
- **Tachy-brady syndrome.** Signals alternate between being too fast and too slow.
- **Sinus pause.** Signals stop from time to time.

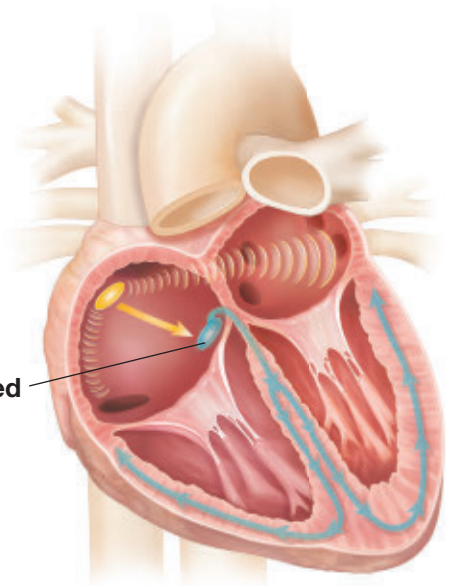
Signal blocked in SA node



AV Node or Bundle Branch Problems

Electrical signals travel from the atria to the ventricles through the AV node and the **bundle branches**. If the signal is blocked at the AV node or doesn't move along the bundle branches, the ventricles don't contract properly. This makes the heart rhythm too slow. When no signals reach the ventricles for a period of time, it is called **heart block**.

Signal blocked in AV node



Fast Heart Rhythms

A fast heart rhythm is called **tachycardia**. It can occur when the heart's electrical signals are sent too often. Or, it can happen if extra signals get sent telling the heart to contract. Fast heart rhythms can affect the atria, ventricles, or both.

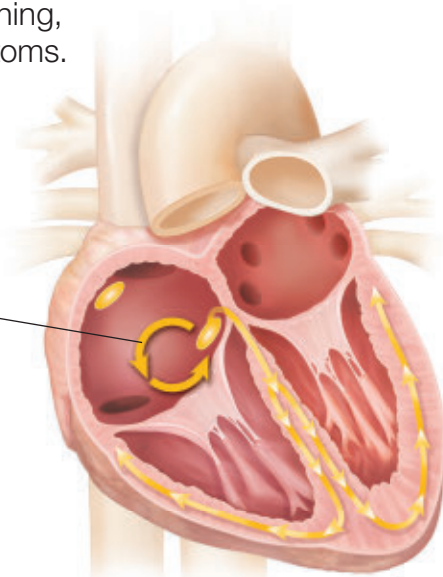
Supraventricular Tachycardia (SVT)

SVT is a series of very fast heart contractions that begin in the atria. SVTs are rarely life-threatening, though they may cause uncomfortable symptoms. Common SVTs include:

AV Nodal Reentrant Tachycardia (AVNRT)

With AVNRT, the AV node is split into two pathways. These can form a small electrical loop (circuit). An electrical signal trapped in the loop can make the atria and ventricles contract over and over. This causes the heart rate to suddenly speed up.

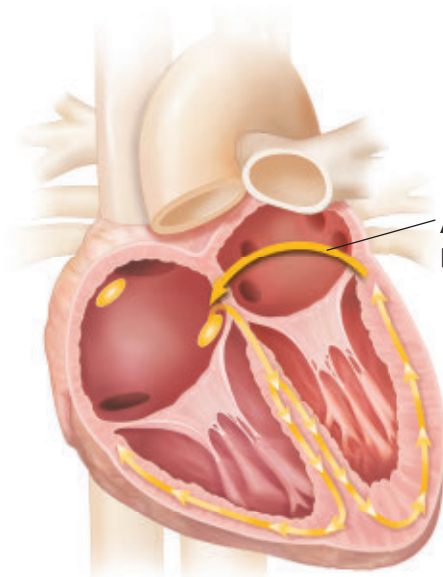
Extra pathway



Wolff-Parkinson-White (WPW) Syndrome

With WPW, the atria and ventricles have an extra pathway. This extra pathway is called an **accessory pathway** or **bypass tract**. Signals that pass through the AV node may reach the extra pathway and loop back to the atria again and again. This causes extra contractions that speed up the heart rate. Most people with WPW were born with the extra pathway.

Accessory pathway

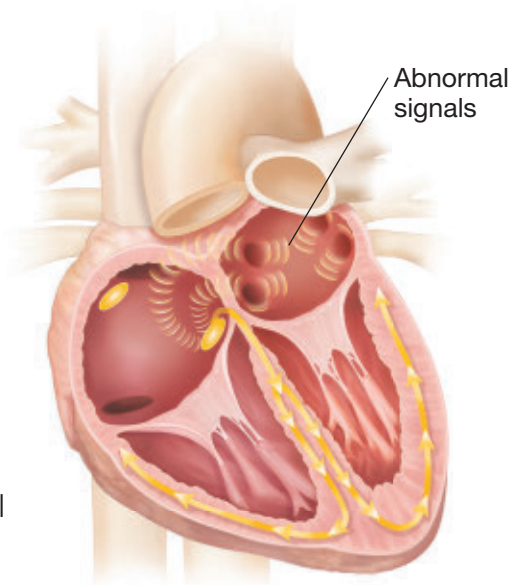


Too many signals may result from extra loops of electrical activity (**circuits**) or from abnormally charged areas of the heart.



Atrial Fibrillation

With atrial fibrillation, the atria receive abnormal signals. These signals are most often sent by cells near where the pulmonary veins connect to the heart. The abnormal signals cause the atria to contract very quickly and irregularly. This can happen all the time (permanent). Or, it can happen just once in a while (paroxysmal).

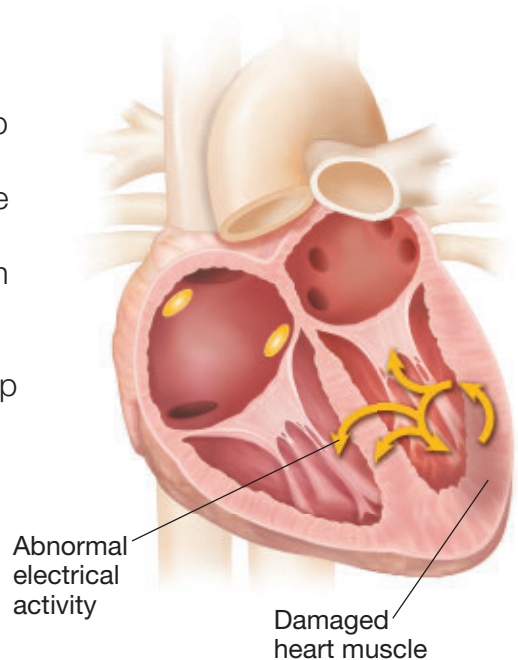


Atrial Flutter

Atrial flutter is often mentioned with atrial fibrillation because they have similar symptoms and medical treatments. Atrial flutter can occur when the right atrium has an abnormal electrical loop (circuit), causing a very fast heartbeat.

Ventricular Tachycardia (VT) and Ventricular Fibrillation (VF)

The ventricles do most of the work to pump blood to the body. So, fast rhythms in the ventricles are often more serious than those in the atria. With VT, abnormal electrical activity develops in the ventricles. This often occurs in areas of damaged heart muscle. VT makes the heart beat very fast, causing the heart to pump ineffectively. It can develop into VF, the most serious arrhythmia. VF is a chaotic, fast, irregular rhythm. It causes the heart to pump little to no blood. Both VT and VF can lead to cardiac arrest, which is life-threatening. Cardiac arrest must be treated right away.



Preparing for an EP Study

An EP study is done by an electrophysiologist. This doctor is trained to diagnose and treat electrical problems in the heart. The study usually takes place in an EP lab at a hospital. You will be told how to get ready. Be sure to follow these instructions.

Before the Study

- You may be asked to have tests ahead of time to check your general health. These can include a chest x-ray or blood tests.
- Tell your doctor about any prescription or over-the-counter medications you take. Also mention herbal remedies or supplements. Be sure to mention if you take a medication to prevent blood clots (blood thinner), any diabetes medications, or a heart rhythm medication (**antiarrhythmic**). You may be asked to stop taking some of them before the procedure. Follow instructions carefully.
- Stop eating and drinking before the study as instructed.
- Arrange for an adult family member or friend to give you a ride to and from the study.



Risks and Complications

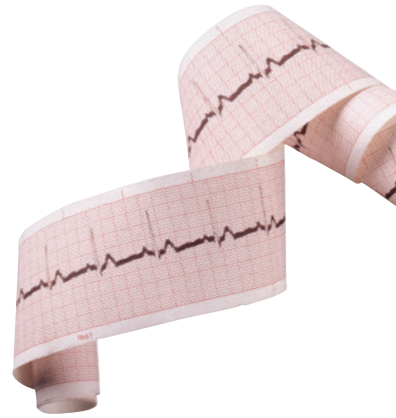
Your doctor will discuss the risks and possible complications of an EP study. They include:

- Bruising
- Bleeding
- Blood clots
- Collapsed lung (pneumothorax)
- Perforation of the heart muscle or a blood vessel
- Stroke or heart attack (very rare)
- Death (extremely rare)



The Day of the Study

- Leave jewelry, laptops, and other valuable items at home.
- When you arrive, you'll change into a cloth gown.
- You may be asked your name and what procedure you're having more than once. This is for your safety.
- The skin on your groin, neck, chest, or arm is cleaned. You're covered with sterile sheets.
- An IV (intravenous) line is inserted into your arm or hand. It delivers fluids and medications. This may include medications to help you relax and prevent discomfort during the study. They will likely make you very drowsy.



In the EP Lab

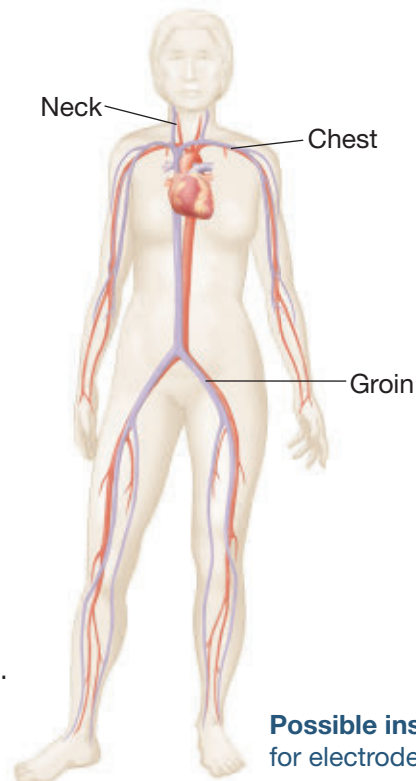
- **The x-ray equipment** creates live images of your blood vessels and heart. In certain cases, other imaging methods, such as ultrasound or 3-D mapping, may be used instead of or in addition to x-rays.
- **Video monitors** show the live images. They are used to guide the wires to your heart.
- **The ECG monitor** shows your heart rhythm at all times.

During an EP Study

An EP study often takes several hours. The doctor is assisted by a team of nurses, technologists, and other staff. If you feel any discomfort during the procedure, tell someone on the team.

Inserting the Wires

The special wires used for an EP study are called **electrode catheters**. First, the insertion site is numbed. Next, a small puncture is made into the blood vessel (vein or artery). The electrode catheters are then inserted. They are guided through the blood vessel into the heart. A video screen shows the catheters as they move through the body. You can't feel the wires in your blood vessels or heart.



Possible insertion sites
for electrode catheters

Studying Your Heart Rhythm

Electrode catheters help find where and when electrical signals begin, how often they're sent, and what pathways they travel. The study can help the doctor see what treatments are needed, if any. During the study:

- Electrical signals may be sent through the catheters to stimulate your heart. If these signals start **(induce)** an arrhythmia, it is recorded.
- If you do have an arrhythmia, the catheters can be used to find **(map)** where abnormal signals are coming from. Medications may be given to speed up the heart rhythm and see how the heart responds.
- Arrhythmias may be stopped by using the catheters to regulate **(pace)** the heartbeat. Less commonly, the heart is given an electric shock **(defibrillation)** to stop an arrhythmia. The team will ensure you do not feel this.
- An additional procedure called **catheter ablation** is often performed to treat an arrhythmia (see page 14).

After an EP Study

When the EP study is completed, the catheters are removed. No stitches are needed to close the insertion site. Pressure is applied for several hours to stop bleeding. You will stay lying down during this time. You may go home the same day or stay overnight. Before you go home, your doctor will likely discuss the study results with you.

When You Return Home

Have an adult family member or friend drive you home. Once you're home:

- Go back to your normal routine as you feel up to it. For most people, this is within a day or two.
- Do only light activities for a few days. Avoid heavy lifting.
- You may have a small bruise or lump under your skin at the insertion site. This is common. It should go away within a few weeks.

▶▶ You can go back to normal activities after your study when you feel ready.



When to Call the Doctor

After the procedure, call the doctor if you have any of the following:

- Unusual redness, swelling, bruising, bleeding, or discomfort at the catheter insertion site
- Numbness, tingling, or swelling in the arm or leg in which the catheters were inserted
- Shortness of breath
- Chest pain
- Fever of 100.4°F (38°C) or higher
- Abnormal heart rhythm that continues or worsens after the study



Treating Heart Rhythm Problems

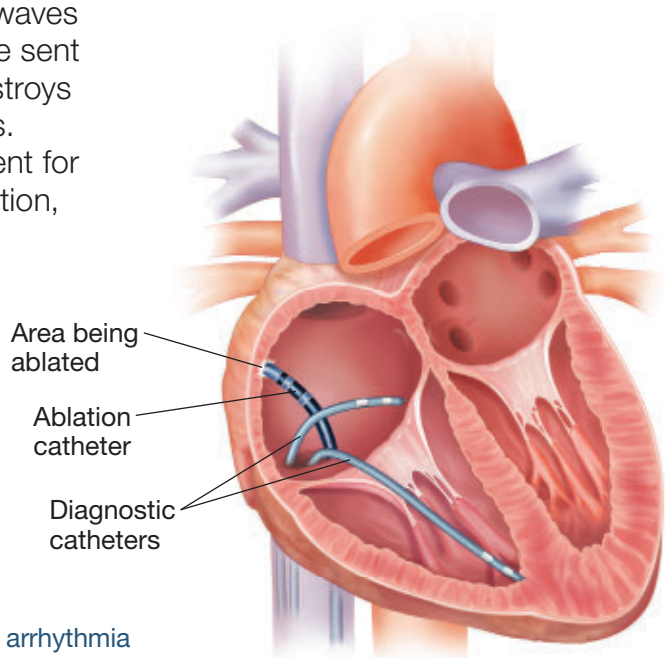
The EP study, along with other test results, will help you and your doctor decide on a treatment plan. In some cases, no treatment is needed. In others, one or more treatments are advised. These may include medications, ablation, or placement of a device. You and your doctor will discuss your results and what they mean for you.

Medications

Certain medications help control an arrhythmia. Medications called antiarrhythmics can help the heart maintain a normal rhythm. Your doctor may prescribe these or another type of medication. Be sure to take them exactly as instructed. Also, tell the doctor about all medications prescribed by other healthcare providers.

Catheter Ablation

Catheter ablation may be done during the EP study. Or, it may be scheduled for a later time. This procedure destroys (**ablates**) an abnormal electrical pathway or group of cells that may be causing an arrhythmia. During the procedure, an **ablating electrode catheter** is placed in the heart. Radiofrequency waves (or another form of energy) are sent through the catheter. This destroys the abnormal pathway or cells. Ablation is a common treatment for problems such as atrial fibrillation, atrial flutter, and other SVTs.

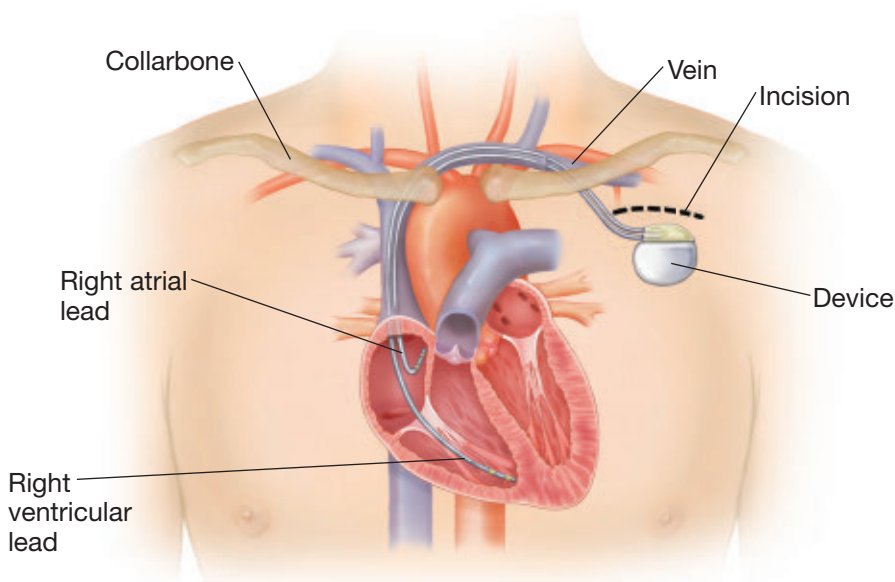


Catheter ablation treats an arrhythmia by destroying abnormal electrical cells in the heart.

Placement of a Device

Certain devices help keep the heart from beating too slowly or too quickly. Depending on the results of your study, one may be prescribed for you.

- A **pacemaker** treats a slow heart rhythm. It is a small, lightweight electronic device. It is placed permanently inside the body. The pacemaker keeps track of the heartbeat. When the heart beats too slowly, it generates electrical signals similar to the heart's natural signals. These signals keep the heart beating at the right pace. Lifelong regular checkups help make sure that a pacemaker continues to run smoothly.
- An **implantable cardioverter defibrillator (ICD)** treats dangerously fast heart rhythms. It is a small electronic device. It is placed permanently inside the body. Like a pacemaker, the ICD monitors the heart's rhythm. If it senses the heart is beating too fast, the ICD can "pace" the heart. This will painlessly stop the fast heart rhythm. If needed, the ICD can also send out one or more electric shocks. These return the heart to its normal rhythm. Lifelong follow-up with the doctor is needed to be sure that an ICD continues to work correctly.



A pacemaker or ICD is usually implanted under the skin in the chest, just below the collarbone.



Moving Forward

An EP study helps you and your doctor to choose the best treatment plan for your heart rhythm problem. If you are given a plan of treatment, follow it carefully. Once your abnormal heart rhythm is under control, you can get on with living your life to the fullest. Keep in touch with your doctor. He or she will monitor your treatment and check for any further changes in your heart rhythm.

Also available in Spanish

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